EFFECT OF RAW, FERMENTED AND HOT WATER TREATED COCOA POD HUSK MEAL BASED DIETS ON THE REPRODUCTIVE TRACT MORPHOMETRY OF RABBIT BUCKS

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ABSTRACT

This study was carried out to determine the effect of feeding raw, fermented and hot – water treated cocoa pod husk meal (CPHM) based – diets on the reproductive tract morphometry of rabbit bucks. A total of sixty (60) cross bred mature rabbit bucks were utilized and randomly allocated to twelve (12) experimental diets containing raw (T_1, T_2, T_3& T_4), fermented (T_5, T_6, T_7, & T_8) and hot – water treated (T_9, T_{10}, T_{11}& T_{12}) CPHM at 0.00, 12.50, 25.00 and 37.50 percent levels of inclusion respectively, in a 3 X 4 factorial arrangement using a CRD. The feeding trial lasted twenty one (21) weeks. Water and feed (formulated diets were both isonitrogenous – 16% and isocaloric – 2500kcal/kgME) were provided *ad-libitum*. At the end of the feeding trial thirty six (36) rabbits (3 per treatment) were sacrificed in the laboratory, dissected and reproductive tracts obtained *intoto*, trimmed of fats and adhering tissues before being subjected to morphometric analysis. Results of the study revealed significant ($P < 0.05$) reduction in absolute weight values of the paired testes and epididymis as well as the length of the caput epididymis in rabbit bucks fed the raw CPHM diets, while fermented and hot – water treated CPHM recorded fluctuating trends. The respective absolute and relative weights as well as lengths of other parameters declined in values as the levels of raw CPHM inclusion increased, while other processed forms had no definite pattern without any significant difference ($P > 0.05$). These findings imply that processed cocoa pod husk meal (fermented and hot – water treated forms)could serves some useful purpose as a non – conventional feed resource in rabbit nutrition and physiology. It is therefore suggested that fermented and hot – water treated CPHM could be included up to 25.00 percent in diets meant for rabbits without fear of compromising their reproductive tract morphometryvis-a- vis reproductive potential.

Keywords: Rabbit, morphometry, cocoa pod husk, theobromine

INTRODUCTION:

The domestic rabbit is one of the micro – livestock species that holds promise in producing high quality animal protein for Nigerians of all ages. Researchers have posited that rabbit production may provide the poor urban dwellers and rural farm families the opportunities to earn additional income on a sustainable manner. The above premise is anchored on the salient attributes of rabbits such as low cost requirements, short gestation period, prolificacy, excellent and rapid growth rate, genetic diversity, ability to utilise forages and agricultural by – products and adaptation over a wide range of ecological zones. Over the years, the rearing and production of rabbits and other animal species have been plagued by the challenges of feeding and feed availability. Most of the conventional feed ingredients are highly demanded for human nutrition, thereby creating a tacit competition between man and animals; leading to expensive feed ingredients that may not be afforded by poor livestock farmers. This development has led to the search for accessible and less expensive agricultural wastes/ by - products in the feeding of animals. By – products of banana (Ekwe, 2011) and cashew had already been successfully utilised in animal feeding trials. Cocoa pod, shell and dust had been incorporated in the diets of poultry and lambs (Abiola and Tewe, 1991); hot – water treated cocoa bean shell based diets had been used in respect of performance and physiological response of weaned rabbits (Adeyina *et al*., 2010).However, the paucity of research findings on the effect of cocoa pod husk meal on the reproductive potential of rabbits has given rise to this study. This study was therefore design to determine the effect of raw, fermented and hot – water treated cocoa pod husk meal based – diets on the reproductive tract morphometry of male and female rabbits, respectively.

MATERIALS AND METHODS

The study was carried out at the Rabbitry Unit of the Teaching and Research Farm, Department of Animal Science, University of Calabar, Calabar, Nigeria. Freshly broken composite cocoa pod husks (derived from improved/hybrid cocoa varieties - CRINc1 – 8, WACRI 11 Hybrids and F3 - Amazon) were obtained from the fermentary units of the Cocoa Research Institute of Nigeria (CRIN) sub - station at Ajassor, Ikom LGA of Cross River State. The broken pods were washed and sun - dried for two weeks, bulked and milled with hammer mill to produce

Cocoa Pod Husk Meal (CPHM). The resultant meal was divided into three (3) portions: The first portion was the raw CPHM (RCPHM); second portion was the Fermented CPHM (FCPHM) while the third portion was Hot water - treated CPHM (HCPHM), respectively. CPHM for the fermented treatment was thoroughly mixed with 60 percent water, relative to its weight and bagged in an air tight polythene bag. This was allowed to stay for three (3) days under room temperature, thereafter, it was opened and shade dried for five (5) days; before being packed, bagged and stored in a cool dry place until it was used. The third portion of CPHM was treated with hot water that was boiled to 100^0C for 15 minutes, which was later drained, shade dried and stored for later use. Twelve (12) experimental diets were formulated to meet the nutrient requirements of the rabbits. Each processed form of CPHM was included at 0, 12.50, 25.00 and 37.50 percent levels for T_1, T_2, T_3, and T_4 (Raw CPHM), T_5, T_6, T_7, T_8 (Fermented CPHM) and T_9, T_{10}, T_{11}, T_{12} (Hot – water treated CPHM), respectively. Diet without CPHM (0 percent) served as control in the experiment. Three rabbit bucks per treatment were dissected and the reproductive tracts obtained *intoto* immediately after slaughter, trimmed of fats and adhering tissues and subjected to morphometric analysis (Bitto *et al.* 2006). All data obtained were subjected to statistical analysis of variance (ANOVA) using General Linear Model for a completely randomized design of GenStat Release 10.3DE (2011). Means were separated by Least Significance Difference (LSD) option.

RESULTS AND DISCUSSION

Results of the reproductive tract morphometry of rabbit bucks are presented in Table 1. In the bucks, reproductive organ weights were statistically similar for all parameters except the paired testes and epididymis which recorded significant difference ($P < 0.05$) between dietary treatments. Results of the linear measurements recorded significant differences ($P < 0.05$) for caput epididymis across dietary treatments, while other parameters were statistically similar. Results of the reproductive tract morphometry of female rabbits showed all parameters to be statistically similar across dietary treatments. The paired testicular and epididymal weight and length of caput epididymis showed significant differences ($P < 0.05$) between dietary treatments, implying that residual theobromine has negative effect on these important male reproductive organs (gonads). The control diet in the raw and fermented groups respectively, produced fairly heavier testes than the CPHM based diets, implying that the residual theobromine depressed testicular growth. As testes weight is related to sperm production. The significant effect of diets on the absolute weights of paired testes observed in this study may imply higher sperm production rates in rabbits fed control diet only; this observation is in consonance with the separate findings of Bitto and Aroh (2006). In all parameters of the reproductive tract morphometry in this study, it was observed that the raw CPHM group recorded the least values in weight and length at the highest inclusion (37.50 percent) level. The observations have confirmed that inclusion of higher cocoa pod husk meal levels and associated theobromine has toxic effect on the gonads and reproductive structures of rabbit bucks. This finding agrees with the observations of other researchers that theobromine and other compounds like caffeine, theophylline, diketopiperazine and pyrazine cause reproductive toxicity targeting the testes, precipitating oligospermia and metabolic disarrangement in animals and sometimes death, especially in rodents (Eteng and Ettarh, 2000).

Conclusion and Recommendation:

The inclusion of fermented and hot – water treated CPHM in the diets for rabbit bucks had not adversely affected the reproductive tract morphometry of the rabbits compared to the toxic effect of the raw CPHM at 37.50% level. It is therefore recommended that CPHM should either be fermented or treated with hot water before they can be included in diets meant for rabbits at a level not exceeding 25.00%.

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Table 1. Reproductive Tract Morphometry of Rabbit Bucks fed Cocoa Pod Husk Meal based Diets

Parameter	RCPHM				FCPHM				HCPHM				
	T_1 0%	T_2 12.50%	T_3 25.00%	T_4 37.50%	T_5 0%	T_6 12.50%	T_7 25.00%	T_8 37.50%	T_9 0%	T_{10} 12.50%	T_{11} 25.00%	T_{12} 37.50%	SEM
Pubertal Bucks (average weight of parameters):													
Average live weight of buck (g)	2050.00^{hi}	2400.00^{f}	1850.00^{ij}	2175.00^{hi}	2475.00^{fg}	1950.00^{ij}	2275.00^{gh}	2275.00^{gh}	2325.00^{gh}	2300.00^{gh}	1875.00^{ij}	1550.00^{k}	48.12
Paired testes (g)	8.48^{b}	8.00^{c}	7.65^{e}	5.12^{g}	5.90^{g}	6.36^{g}	11.00^{a}	8.99^{b}	9.18^{a}	8.74^{cb}	10.96^{a}	7.75^{e}	0.53
Paired epididymis (g)	6.63^{a}	5.99^{a}	2.20^{c}	1.77^{d}	5.70^{a}	3.38^{b}	2.02^{c}	2.30^{c}	1.48^{d}	3.31^{b}	2.03^{c}	1.02^{d}	0.55
Caput epididymis (g)	0.42	0.58	0.31	0.35	0.69	0.81	0.56	0.47	0.52	0.50	0.33	0.31	0.05
Corpus epididymis (g)	1.81	0.44	0.20	0.22	0.24	0.15	0.11	0.14	0.17	0.15	0.11	0.10	0.14
Cauda epididymis (g)	0.73	0.14	0.08	0.17	0.55	0.08	0.09	0.06	0.11	0.12	0.04	0.02	0.06
Testes volume (ml)	2.00	2.25	2.00	1.25	1.75	3.75	4.25	2.25	4.00	3.50	4.25	3.75	0.32
Gonadosomatic index (GSI) (%)	0.41	0.33	0.38	0.45	0.24	0.33	0.48	0.40	0.40	0.38	0.59	0.73	0.05
Relative weight of reproductive organs (% live weight of bucks):													
Paired testes	0.41	0.33	0.38	0.24	0.24	0.33	0.48	0.40	0.40	0.38	0.59	0.50	0.03
Paired epididymis	0.32	0.25	0.12	0.08	0.23	0.17	0.09	0.10	0.06	0.14	0.11	0.07	0.02
Caput epididymis	0.02	0.02	0.02	0.02	0.03	0.04	0.03	0.02	0.02	0.02	0.02	0.02	0.002
Corpus epididymis	0.09	0.02	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.007
Cauda epididymis	0.04	0.01	0.01	0.01	0.02	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.003
Linear measurements (cm):													
Testicular length	6.75	4.75	3.75	4.00	6.50	6.50	6.50	8.50	7.75	7.25	6.75	5.50	0.42
Entire epididymis length	17.50	12.50	12.25	9.00	10.50	7.25	7.50	8.05	7.50	8.75	7.75	8.00	0.73
Caput epididymis length	4.75^{a}	2.75^{e}	2.25^{f}	1.75^{g}	3.25^{b}	2.50^{e}	2.00^{g}	1.80^{g}	1.75^{g}	2.75^{e}	1.75^{g}	1.25^{g}	0.24
Corpus epididymis length	7.75	6.75	5.50	5.25	4.25	2.75	3.50	3.25	3.75	3.50	3.00	3.75	0.32
Cauda epididymis length	5.00	3.00	4.50	2.00	3.00	2.00	2.00	3.00	2.00	2.50	3.00	3.00	0.28

Parameter	RCPHM				FCPHM				HCPHM				
	T_1 0%	T_2 12.50%	T_3 25.00%	T_4 37.50%	T_5 0%	T_6 12.50%	T_7 25.00%	T_8 37.50%	T_9 0%	T_{10} 12.50%	T_{11} 25.00%	T_{12} 37.50%	SEM
Pubertal Bucks (Average weight of parameters):													
Average live weight of buck (g)	2050.00^{ac}	2400.00^{a}	1850.00^{c}	2175.00^{bc}	2475.00^{a}	1950.00^{c}	2275.00^{b}	2275.00^{b}	2325.00^{ab}	2300.00^{ab}	1875.00^{c}	1550.00^{c}	48.12
Paired testes (g)	8.48^{b}	8.00^{c}	7.05^{e}	5.12^{g}	5.90^{d}	6.36^{d}	11.00^{a}	8.99^{b}	9.18^{a}	8.74^{ab}	10.96^{a}	7.75^{e}	0.53
Paired epididymis (g)	6.63^{a}	5.99^{a}	2.20^{c}	1.77^{d}	5.70^{a}	3.38^{b}	2.02^{c}	2.30^{c}	1.48^{d}	3.31^{b}	2.03^{c}	1.02^{d}	0.55
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Corpus epididymis (g)	1.81	0.44	0.20	0.22	0.24	0.15	0.11	0.14	0.17	0.15	0.11	0.10	0.14
Cauda epididymis (g)	0.73	0.14	0.08	0.17	0.55	0.08	0.09	0.06	0.11	0.12	0.04	0.02	0.06
Testes volume (ml)	2.00	2.25	2.00	1.25	1.75	3.75	4.25	2.25	4.00	3.50	4.25	3.75	0.32
Gonadosomatic index (GSI) (%)	0.41	0.33	0.38	0.45	0.24	0.33	0.48	0.40	0.40	0.38	0.59	0.73	0.05
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Caput epididymis	0.02	0.02	0.02	0.02	0.03	0.04	0.03	0.02	0.02	0.02	0.02	0.02	0.002
Corpus epididymis	0.09	0.02	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.007
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Caput epididymis length	4.75^{a}	2.75^{c}	2.25^{c}	1.75^{c}	3.25^{b}	2.50^{c}	2.00^{c}	1.80^{c}	1.75^{c}	2.75^{c}	1.75^{c}	1.25^{d}	0.24
Corpus epididymis length	7.75	6.75	5.50	5.25	4.25	2.75	3.50	3.25	3.75	3.50	3.00	3.75	0.31
Cauda epididymis length	5.00	3.00	4.50	2.00	3.00	2.00	2.00	3.00	2.00	2.50	3.00	3.00	0.28

$^{abc...d}$ means on the same row with different superscripts are significantly different (P< 0.05)